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ABSTRACT

The Federation of Rocky Mountain States and the Satellite Technology Demonstration project (STD) have collaborated in an effort to provide low cost information delivery to rural areas of the Rockies. Though the goals and the financial support of this joint effort were initially confused, sites have now been selected, the communications technology has been refined, and services have been stablilzed. New satellite technology has made quality reception possible with low-cost ground receivers, and the technical performance of the system in its initial years has been good. "Time Out"--a career education program for junior high school students--and "Footprint"--a series of community-oriented programs--have enjoyed high audience response, and substantial gains in student knowledge have been recorded. Programs are enhanced by supplementary publications and audiovisual aids, and the system provides an interactive mode whereby students can ask questions and make comments about the programs. A brief review of the program's financial support is included. (EMH)

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EXECUTIVE REPORT

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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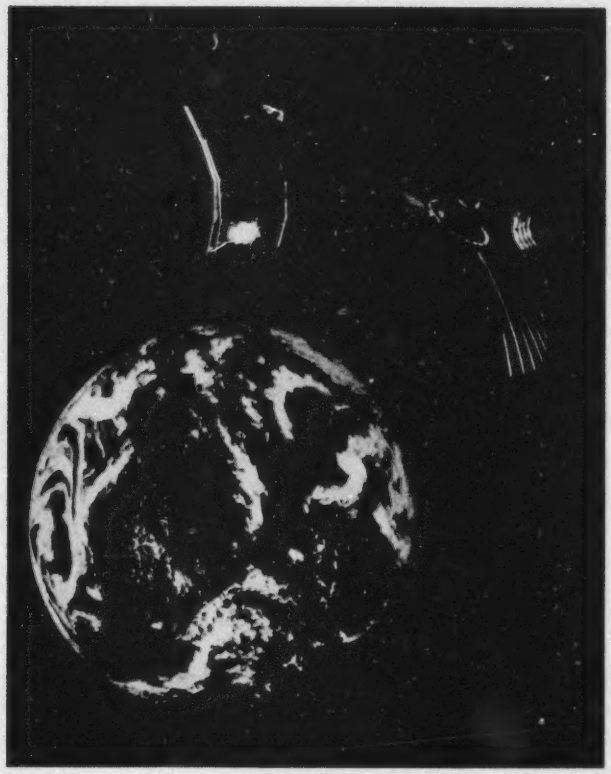
SATELLITE TECHNOLOGY DEMONSTRATION
FEDERATION OF ROCKY MOUNTAIN STATES INC.



The following document has been prepared to provide the reader with a brief but comprehensive review of the Satellite Technology Demonstration (STD) from its inception in January, 1972, through August, 1975.

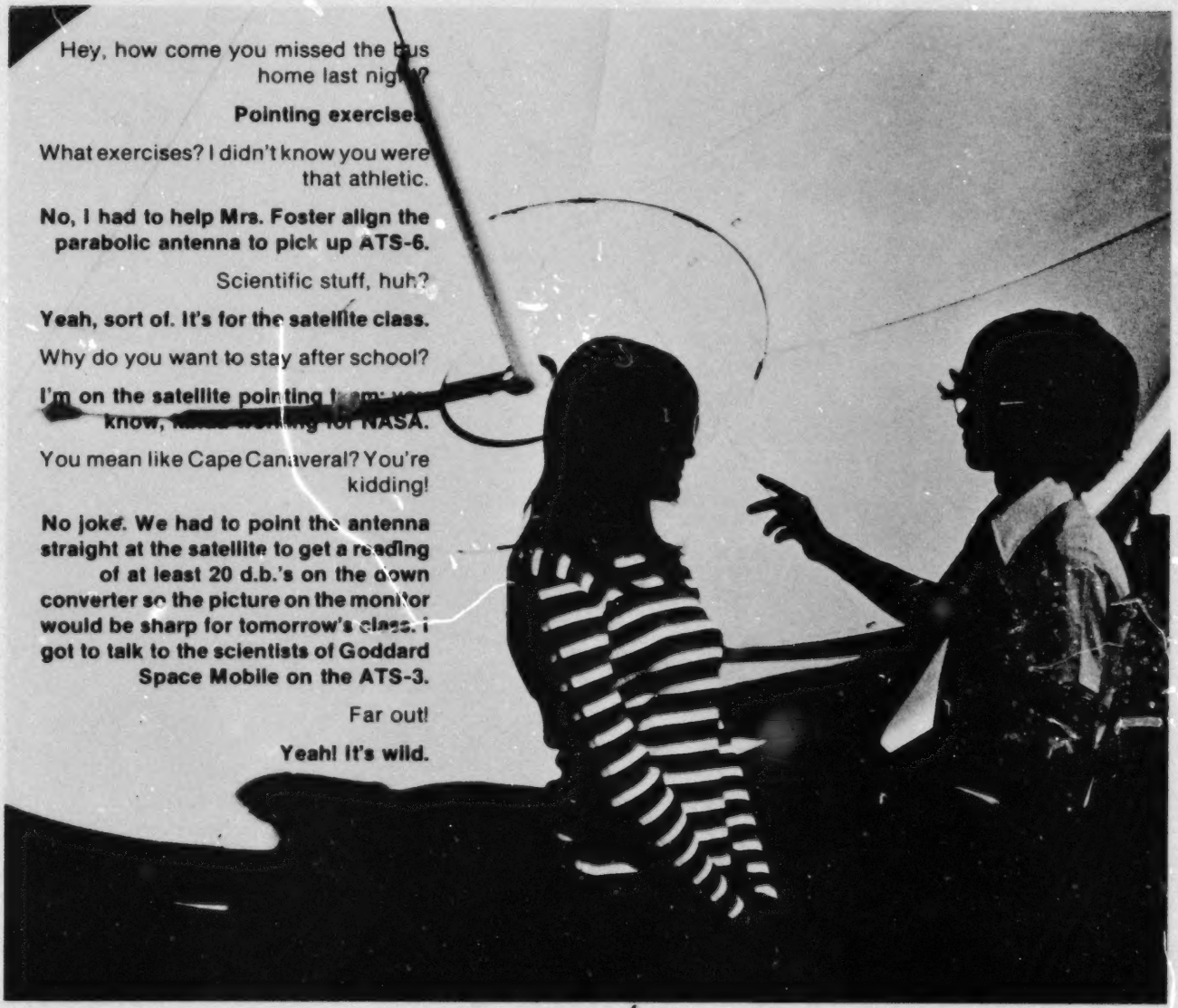
The significance of the potential contributions of the Demonstration was expressed in a 1972 statement by Cecil D. Andrus, Governor of Idaho:

"I feel confident that there is a promise of real benefit to mankind in this project. If we can truly provide a system of communication among the people of this region, we must be but moments away from the time when we can say we have helped solve the basic educational disparity between the community school and the fundamental principles of liberty, equality, and open opportunity for all people."

This potential was demonstrated. As Project Director, I know that the realizations and accomplishments of the STD will have a far-reaching impact on the future of telecommunications.

Dr. Gordon Law
Project Director, STD
September 15, 1975

Acceptance of social or technological change is revealed in our use of new terminology to describe our experience with innovation. Everyday conversations of STD users reflect the changing language of a new era of telecommunications. Words such as *uplink, parabolic antenna,* and *down converter* are a part of the vocabulary of students and teachers who have incorporated this new terminology in their lives.



Hey, how come you missed the bus home last night?

Pointing exercises.

What exercises? I didn't know you were that athletic.

No, I had to help Mrs. Foster align the parabolic antenna to pick up ATS-6.

Scientific stuff, huh?

Yeah, sort of. It's for the satellite class.

Why do you want to stay after school?

I'm on the satellite pointing team; you know, [illegible] for NASA.

You mean like Cape Canaveral? You're kidding!

No joke. We had to point the antenna straight at the satellite to get a reading of at least 20 d.b.'s on the down converter so the picture on the monitor would be sharp for tomorrow's class. I got to talk to the scientists of Goddard Space Mobile on the ATS-3.

Far out!

Yeah! It's wild.

Suite 300 - B
2480 W. 26th Avenue
Denver, Colorado 80211
Phone 303-458-8000

**Federation of
Rocky Mountain States, Inc.**

The Honorable F. David Mathews
Secretary of Health, Education and Welfare
300 Independence Avenue, S.W.
Washington, D.C. 20201

September 15, 1975

Dear Mr. Secretary:

The Satellite Technology Demonstration was the first major effort to use a communications satellite, the ATS-6, for the delivery of social services to geographically isolated communities. This Demonstration and other Health, Education, Telecommunications Experiments hold the promise that social services can be extended to more people at reduced costs. This Project has brought us full circle. The nation probed space originally to learn more of the universe and of our own earth. However, with the advent of the STD, we are now using space discoveries and space itself in service to mankind.

This technology is now available and has been proven feasible for practical use, and the demand for it has been documented. This Project has set an inexorable trend which will continue until the expressed needs of the user populations have been satisfied. Our challenge will be to continue development and apply judiciously the use of this capability, motivated by potential human benefits. The technology has been exposed as an aid to the practitioner. It is not a trouble-free aid, and is fraught with numerous pitfalls. In spite of this, it holds great promise.

The ATS-6 has now been moved from its original position to provide telecommunications service to India. This allows United States users time to evaluate and reflect upon their experiences during the first year of operation with this versatile and complex communications technology.

The Federation of Rocky Mountain States was proud to participate in the Satellite Technology Demonstration. Our participation exemplified a basic tenet of our organization--that problems and opportunities are no respecters of geographic boundaries, and that states can pool their resources and effectively participate in regional projects.

The Federation is indebted to many agencies and individuals in education, government, and business whose contributions made the Satellite Technology Demonstration a success. We are particularly indebted to the STD staff for their dedicated efforts, to the personnel in the state sponsoring agencies, and to the teachers and site coordinators and students in our local sites for their support and contributions. Ours has been a regional project, which we have successfully integrated into the activities and programs of ongoing state and local agencies. On a smaller scale, we have been a Demonstration of what can occur on the national, even international, level given careful planning and incorporating the ideas and concerns of the constituencies participating in the programs.

The technical capability has arrived--we eagerly await its broader application.

Sincerely,

Jack M. Campbell

Jack M. Campbell
President

A composite reaction of the 56 school superintendents who participated in the STD would reflect their awareness that change is inevitable, their willingness to change, their belief that technology must be applied to education, and their desire to extend their participation to future satellite projects:

"It all started early in the spring of 1973 when I received a letter from a new project called the Satellite Technology Demonstration inviting me to a state 'get-acquainted' meeting to discuss the use of space-age technology for distributing educational services into selected schools in the region. Many questions were asked and nearly everyone at the meeting expressed interest in obtaining further information.

When Project representatives came to our town, they talked with staff members and me, school board members, and people in town. They learned that the population of our community is about 2,300, but that our school population is around 900 because youngsters come from farms as far as 20 miles away. They seemed particularly interested in our rural setting and the school's willingness to support an experimental program. As a result, we were notified in the summer of 1973 that we had been selected as an STD site.

By the spring of 1974, things began to happen. We had to decide which students would participate, which teacher would serve as our local coordinator, and which room would be used for television viewing. We also had to order our color television monitor and videotape cassette recorder.

By late spring, our plans were made and teacher and student interest was reasonably high. Their interest and curiosity were markedly increased about a week before summer vacation when the STD technicians came and installed a receiving antenna and a protective fence.

During the summer, the technicians returned to complete the equipment installation and to make final tests. Also during the summer, Mrs. Martin, the teacher selected as local coordinator, and Mr. Pappas, the junior high principal, attended a three-day training session conducted by the Project.

As soon as school opened in the fall, Mrs. Martin was busy obtaining pre-test data on the students enrolled in her STD class. She also collected data from the school staff and members of the community. Everyone who saw the programs was amazed at the high quality of the video and audio reception we were able to obtain. Initially, there were difficulties with the quality of the audio interaction system, which used a different satellite. However, within a couple of months the problems were worked out.

The students enjoyed the programs and seemed to learn from them. The librarian and counselor stated that students asked more questions and showed more interest in careers. While there were some parts of programs and audio interaction which they would like to see changed, they encouraged other students to take the course second semester.

Some of the staff took the in-service training course for college credit. The STD made arrangements with one of our state colleges to grant graduate credit for participation.

One of the most popular services the STD provided was called Materials Distribution Service. Excellent films on many subjects for all grade levels were available to us. It was an outstanding service for our schools. Some days we had as many as four or five classes viewing different MDS films which we had videotaped. Because of copyright expenses, we will not be able to afford all the MDS films we taped and are now reviewing them to select those we will keep and reuse.

The STD also provided a program for community adults. Although the people who came to watch seemed to enjoy it, we were never able to attract the size audience we would have liked. I believe that any future programming of this type should be a series of short courses such as budgeting, first aid, landscaping, and community planning.

In looking back, I believe everyone in our school and community feels that our involvement in the STD was a good experience. The Project had its strengths and its weaknesses, and the reporting was a lot of work; but we gained from it and realize that it has great potential.

Would we be willing to participate in the next satellite project ? You bet ! We're hoping that our school will become the communications center of our community."

GOODBYE TO THE GREAT DIVIDE

In 1895, Guglielmo Marconi directed wireless signals from one end of a room to the other. Six years later, powerful transitters exchanged "marconigrams" between Poldhu, England, and St. Johns, Newfoundland.

In 1966, NASA's first Applications Technology Satellite, the ATS-1, linked isolated Alaskan communities via a satellite/radio network. Eight years later, NASA's sixth communications "bird," the ATS-6, beamed live, full-color television programs to participants in telecommunications experiments in sparsely populated regions of the United States. In the Rocky Mountain region the experiment was the Satellite Technology Demonstration (STD).

Modern communications technology, typified by daily satellite transmissions which bridge entire continents, confirmed Marconi's prediction that telecommunications would become the "almost unnoticed working equipment of civilization." Now, new vistas of telecommunications technology have been explored, as federal, state, and local agencies in the fields of health, education, and social services seek to develop new technological means to satisfy human needs and solve social problems.

Robert Jastrow, Director of the Goddard Institute of Space Studies, foresees a fifth revolution involving space telecommunications which will be even more radical than the four previous revolutions of speech, writing, printing, and radio. "In the long run," Jastrow predicts, "the new satellites will provide a nervous system for mankind, knitting members of our species into a global society."

Fifty-six communities scattered throughout eight Rocky Mountain states have completed a preview of this telecommunications revolution. Ranchers, farmers, carpenters, bankers, teachers, students, and others in communities as economically and culturally diverse as Peñasco, New Mexico, and West Yellowstone, Montana, have used the powerful medium of satellite television to maintain dialogue with the staff of the STD. The process proved that extensive and inexpensive communication across large expanses of the earth is not only possible, but desirable and productive. Along with performing highly technical and scientific functions of data collection, ionospheric analysis, and high altitude photography, satellites have now secured a welcome place in the school classroom.

The STD staff succeeded in transforming an untested communications concept into the largest non-military, extra-terrestrial telecommunications system in the world. As television continues its second quarter-century, the Satellite Technology Demonstration's pioneering efforts provide a documented report of potential benefits awaiting mankind.

THE FEDERATION

The Federation of Rocky Mountain States, Inc., headquartered in Denver, Colorado, is the parent organization of the Satellite Technology Demonstration.

The Federation was established in 1966 by the Governors of the states of Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming. They were joined by business and industry to provide a forum to address problems and promote the orderly development of the region.

The organization continues to work in the areas of natural resources, regional planning, market development, arts and humanities, environment, transportation, human resources, and telecommunications and was the catalyst for the establishment of public broadcasting in the region. It was this experience, coupled with its educational work, that prompted the U.S. Department of Health, Education, and Welfare to approach the Federation to become the planning and implementing agent for the Satellite Technology Demonstration.

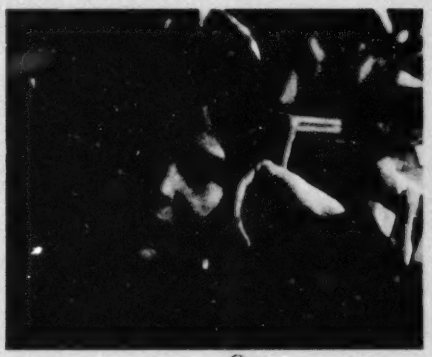
The Satellite Technology Demonstration was designed to utilize NASA's Applications Technology Satellite (ATS-6), the most complex, versatile, and powerful spacecraft ever developed. The ATS-6 served as a broadcasting station 22,300 miles in space. With sophisticated electronics aboard, it was used to conduct a series of technological and scientific experiments.

The STD was a part of the larger Health, Education, Telecommunications (HET) Experiment which delivered television programming to small, low-cost receiving stations in Alaska, the Pacific Northwest, the Appalachian region, and the Rocky Mountain states. The HET Experiments were developed for areas where people are relatively isolated, both geographically and culturally.

The Rocky Mountain West is a panorama of striking contrasts covering over 860,000 square miles but inhabited by only 4 percent of the nation's people. The land contains a spectrum of ethnic groups, cultures, and subcultures. Perhaps nowhere in the nation do ethnic groups cling more to their ancestral ethos than do the Mexican Americans, Native Americans, and Basques of the Rocky Mountain West. As this enormous rural empire moves toward urbanization, the contrasts between the past and the future become more evident.

In this mountain setting, the Department of Health, Education, and Welfare was seeking answers to such questions as: Can satellites deliver information to people who cannot be reached easily, quickly, or economically by other means? What are the actual costs involved? How do people in rural areas react to information being received and sent via satellite? What services and what presentation techniques are best suited to a satellite broadcast system?

The Satellite Technology Demonstration sought answers to these questions while pioneering the satellite delivery of educational and social services to citizens in remote areas of the Rocky Mountain states. The two major Project objectives were to demonstrate the feasibility of a satellite-based media distribution system for rural populations and to test and evaluate user acceptance and the cost of various delivery modes using a variety of materials.



SATELLITE TECHNOLOGY DEMONSTRATION

In the late sixties, the Federation played an important role in developing a regional educational television corporation which has now become the twelve-station Rocky Mountain Corporation for Public Broadcasting. These stations, because of their locations in major cities, reach over 80 percent of the mountain states' population, but do not serve many of the region's citizens who reside in rural, isolated areas.

In 1968, 1969, and 1970, the Federation submitted proposals to the Office of Education, Department of Health, Education, and Welfare to utilize satellite potential by developing and delivering programming to rural, isolated schools. None of these proposals was funded.

Early in 1971, the DHEW requested that the Federation submit a proposal for use of broadcast time on ATS-F (the designation for the ATS-6 prior to launch). The Federation responded with a preliminary plan for programming in career education, early childhood education, and higher education. A significant cooperative effort was anticipated among Denver-based regional and national educational agencies to implement the plan.

In May of 1971, the Office of Education awarded the Federation a planning contract to prepare for a satellite experiment. Extensive planning was conducted with regional input from state governments, teacher groups, students, the business community, broadcasters, and minority group representatives. The following content needs were identified: early childhood education, occupational awareness, occupational training, communications skills, environmental studies, a variety of college academic courses, public service education, counseling, and communications.

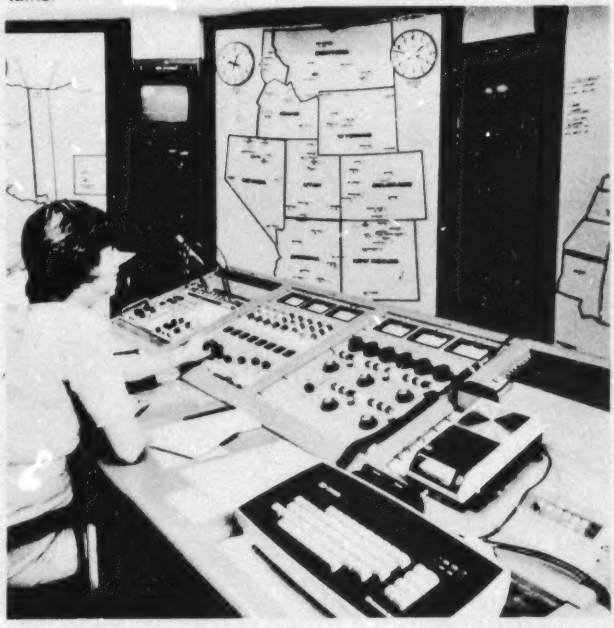
The Office of Education responded to the Federation proposal by making an FY '73 commitment of $5,000,000 for a limited satellite "experiment-demonstration" to include career education and early childhood education programming.

In January, 1972, a six-month planning grant provided for program development in career education and early childhood education and established a production-engineering component responsible for ground-system equipment and all production. Engineering planning was based on the assumption that program transmission would include public broadcasters in the region, cable and translator systems, and individual sites unreachable by existing systems. Planning addressed one-way video, two-way video, one-channel audio, four-channel audio, computer-assisted instruction, computer-managed instruction, and remote uplink video-audio mixes to be used in various combinations.

The history of the STD was characterized by a shifting of Project objectives by the funding agencies, changing federal agency and management responsibilities, and limiting the Project scope. Limitations included fewer installations, types of terminals, technical capabilities, broadcast schedules, and content development. All these changes — related to reduced funding — altered the STD.

The Project evolved into a quasi-research experiment and technical demonstration with limited objectives. Nevertheless, individuals and organizations involved in planning and implementation activities

The **Network Coordination Center** in Denver, Colorado was the nucleus for receiving, transmitting, relaying, monitoring, and controlling HET ground network activities throughout Alaska, the Pacific Northwest, the Appalachian region, and the Rocky Mountains.



continued to pursue a "service-delivery" system rather than a "limited-experimental" mode. The service orientation remained because there was a regional demand to be addressed which far exceeded the available funding. It is commendable and noteworthy that during all of the negotiations (which reduced the number of sites, broadcast time, programming scope, and number of participants) the individual school districts maintained interest in the STD and sought to be included in the Project.

In addition to the narrowed scope of the Project, other difficulties were encountered. Late payments on the federal contracts and grants imposed hardship in planning and implementation schedules. The Federation developed new strategies in response to the delays and changing objectives of the funding agencies. It also organized the input from state agencies, local communities, educational groups, and involved members of business and industry. These constituencies were kept informed of changes as they occurred and of the reasons for such changes. Within the STD project, reshaping, refinement, and accommodation were taking place to develop an organization responsive to user needs. Programs were produced to specifications derived from the needs of regional audiences and were modified by suggested changes.

Several components were established to execute Project tasks. Management was charged with the responsibility of developing and implementing Project revisions, supervising the work of various components, managing budgets, and submitting successive proposals.

The Broadcast and Engineering component was involved in the design of transmitter and receiving hardware and the design, bidding, and procurement of the master earth station in Morrison, Colorado. This component worked closely with field service personnel in identifying receiving sites which had to meet certain demographic characteristics for evaluation purposes. Military and other regulatory agency frequency clearances had to be secured for each site. The design, testing, procurement, and installation of equipment at the rural Rocky Mountain sites was a herculean task. In addition to designing the low-cost ground transmitters and receivers, the Broadcast and Engineering staff designed and built the Network Coodination Center in Denver, capable of interfacing with NASA centers at Greenbelt, Maryland; Mojave, California; and Rosman, North Carolina. The component was also responsible for installing the ground equipment in the Appalachian region and for coordinating activities in Alaska, the Pacific Northwest, and the Appalachian region.

The Program component conducted an educational needs assessment in the eight participating states. This component also reviewed and evaluated existing career education materials, developed the preliminary educational content objectives, and produced the programming ultimately broadcast by satellite.

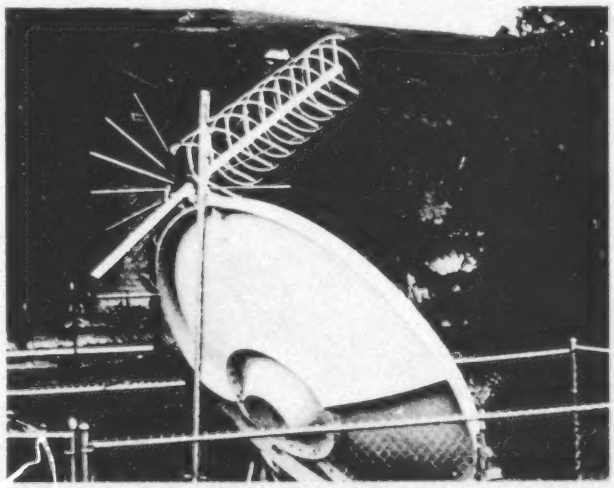
Two courseware teams were charged with writing and producing the junior high career education series ("Time Out") to be delivered via satellite. Teacher and student guides were developed to supplement this series. Also produced was an adult, community-oriented program series of 10 programs entitled, "Footprints," and a graduate level in-service series of 16 programs entitled, "Careers and the Classroom: A New Perspective for Teachers." Another function (Materials Distribution Service) consisted of transmitting over 400 existing films, which the sites recorded on videotape for classroom use at their convenience.

The Research component designed and im-

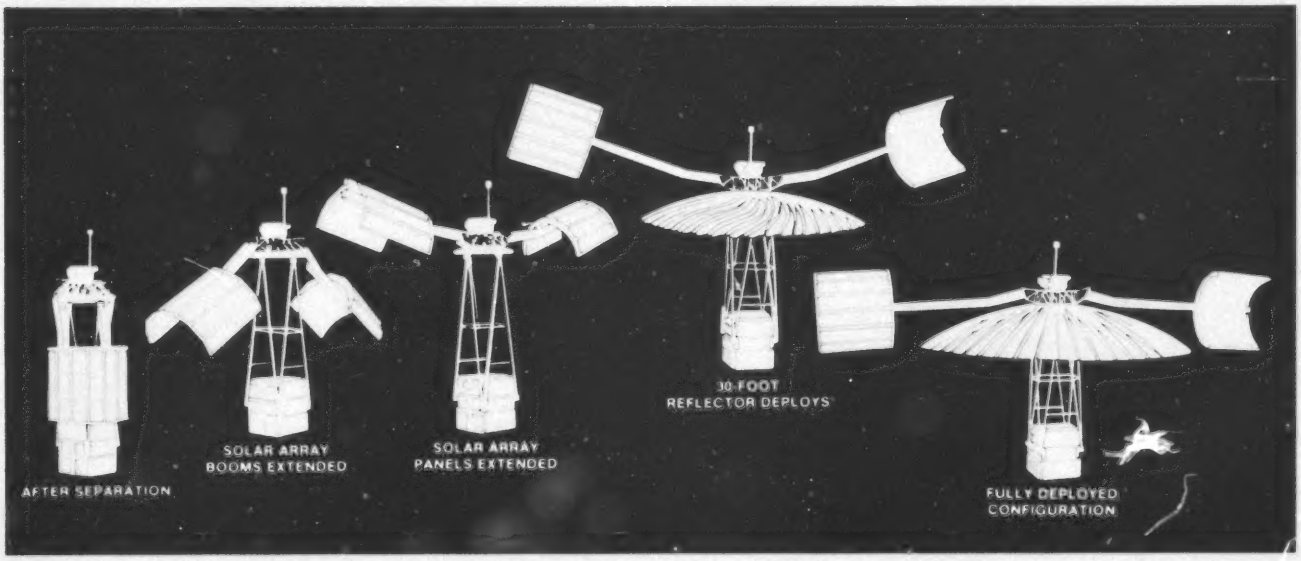
plemented data-gathering and evaluation procedures; developed instruments to evaluate the performance and costs of both hardware and software; and studied attitudes of students, parents, teachers, administrators, and the general public. A national research committee was created to advise the component.

The Utilization component was established to provide field services. Staff members visited and gathered demographic material on potential sites — an activity which required close coordination with the governor's office in each of the eight states, the state departments of education, the state telecommunications agencies, and numerous professional and civic organizations. School boards, superintendents, principals, mayors, county commissioners, tribal chiefs, state legislators, state department heads, governors' aides, and governors were kept current on STD site selection and changes in Project scope or orientation. The component assisted the content specialists in determining the levels of greatest educational need and in developing the pilot programming which provided guidance for content development.

As the Project matured, the Utilization component was charged with establishing a service component in each state. This involved employment of a resident state coordinator to work with STD staff and all in-state entities involved in the Project. At each selected site, a local part-time coordinator was selected by the school superintendent. The entire state structure was jointly funded by Project, state, and local funds, with a major share paid by local and state governments. Contracts were negotiated with each state and site to clarify such details as insurance, transportation, broadcasts during out-of-school hours, regional meetings, equipment, custodial care, and security.

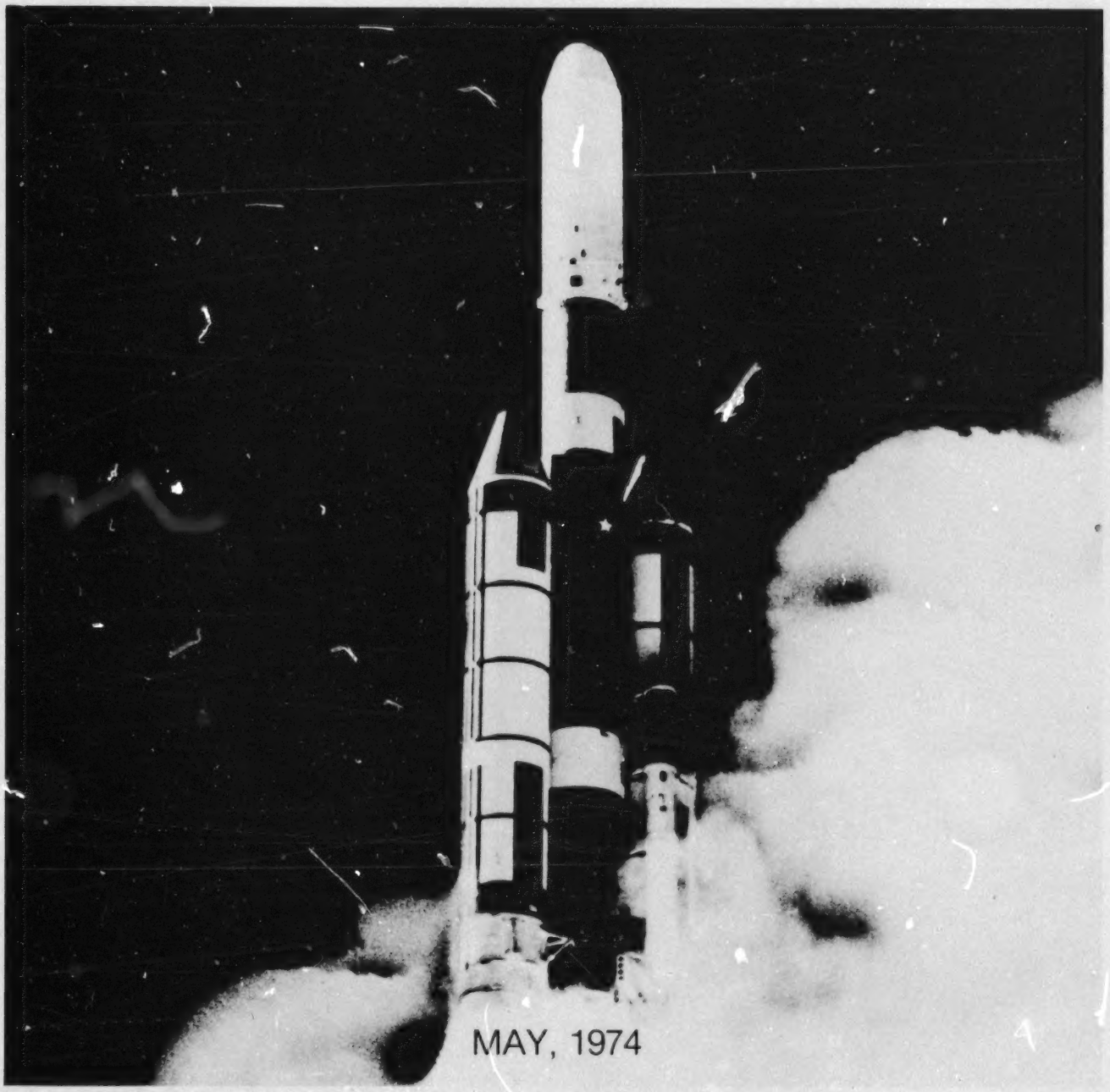


One hundred nineteen **2.5 GHz Receive-Only Terminals**, used in one or more of the HET experiments, received television services provided by the ATS-6. The terminals consisted of a 3.05 meter (10 ft.) segmented parabolic reflector, an antenna-mounted low-noise transistor preamplifier, and an indoor demodulator unit. At 47 of the HET sites, 24 of which were STD sites, the circularly polarized **helical antenna** simultaneously transmitted and received two-way voice and data signals via the ATS-1 and the ATS-3.



Public information activities, a part of Project management, were geared to develop awareness and acceptance among the many STD constituencies. A flow of accurate information was vital, especially since the Project was new, complex, and operated on such a large scale. Public information audiences included local, state, regional, national, and international constituencies. Emphasis, however, was placed on public information activities at the state and local level. Brochures, printed displays, media presentations, and a mobile display were utilized. Requests for presentations at meetings by STD project staff were coordinated by the public information office.

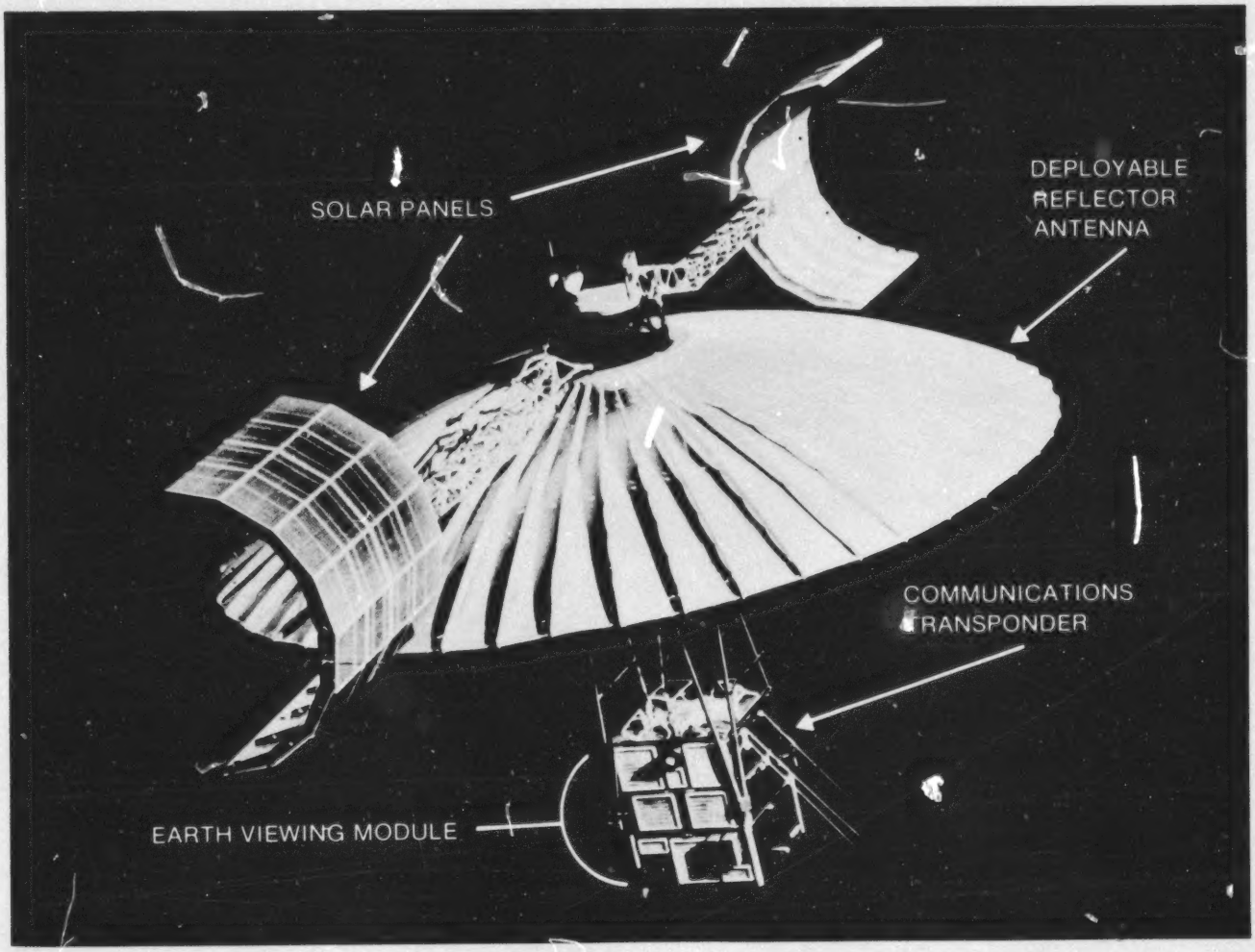
The ATS-6, which was used for the Health Education Telecommunication experiments, was one of the most complex, versatile, and powerful comunication spacecrafts ever developed. Here the satellite is deployed for testing by Fairchild Industries engineers at Germantown, Maryland.



MAY, 1974

On May 30, 1974, NASA launched the ATS-F from Cape Canaveral. As it moved into its geosynchronous orbit 22,300 miles over the equator, the ATS-F was designated ATS-6, indicating its new operational status. It was now ready to respond to signals from the ground and to support 23 separate experiments. Six of these concentrated on the delivery of social services in health and education to selected rural residents. The largest of the six was the Satellite Technology Demonstration, located in Denver, Colorado.

While there were many last-minute adjustments to equipment, retakes of television material, and calls to suppliers who failed to meet delivery schedules, the Project was ready and anxious to become operational.



THE ATS-6 SPACECRAFT

The ATS-6 spacecraft is the most complex and powerful communications system developed in the 15-year history of communications satellites. Its high-powered receiver/transmitter system, coupled with a large parabolic reflector antenna, relayed high quality color television, audio, and digital signals simultaneously to a large number of small, inexpensive ground stations scattered over a large geographic area.

The spacecraft weighs 3,090 pounds, is 26 feet high, and with solar array booms extended measures 52 feet from solar panel to solar panel. More than 21,000 solar cells capture energy from the sun to power the satellite's command, propulsion, attitude control, telemetry, and experimental mechanisms.

THE COMMUNICATIONS SYSTEM

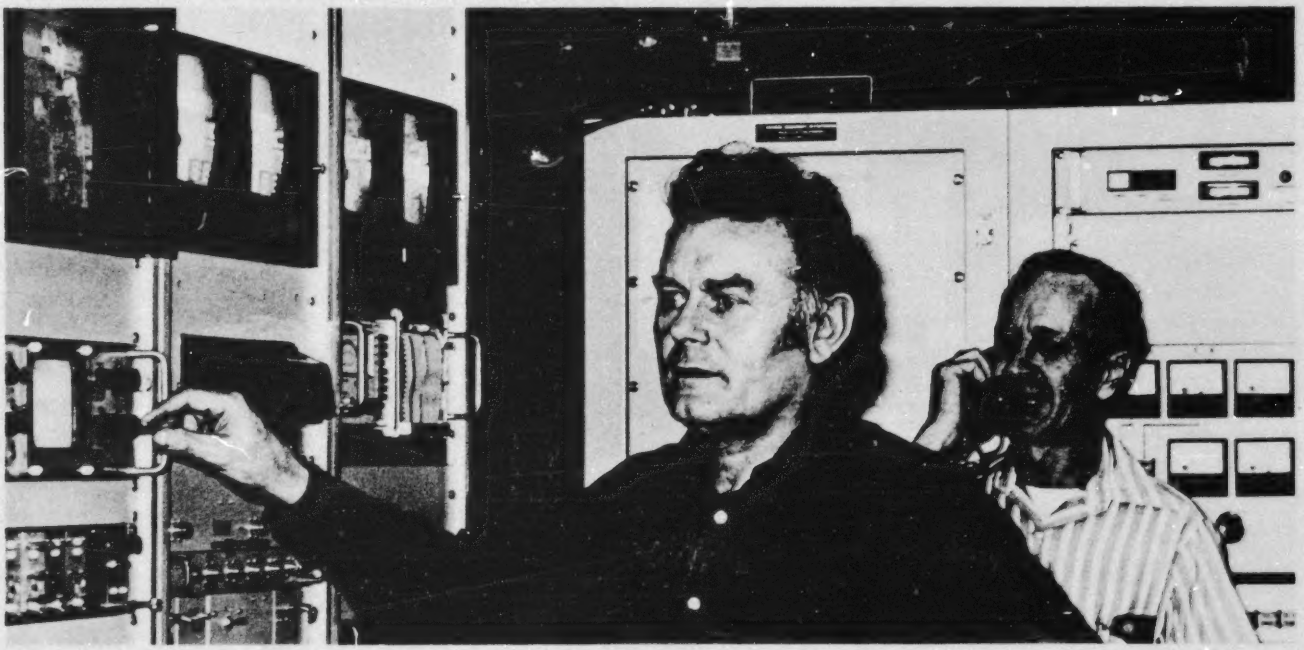
Only a few years ago, man had to build giant earth stations costing hundreds of thousands of dollars to communicate with the satellites launched into space. However, the ATS-6 introduced a powerful new broadcast capability to the art of satellite telecommunications. Unfolded in space, the satellite's parabolic reflector resembles a giant umbrella large enough to cover a house. The communications signals, concentrated by the inverted bowl-shaped structure, are so powerful and so highly directional that they can be picked up by a low-powered receiving system. The STD established that the high-gain antenna and high-powered transmitters on the AST-6 can communicate with simple, inexpensive ground terminals.

The two television transmitters provided remote areas with a reception quality better than that enjoyed by many urban communities served by conventional commercial and public television channels. Each transmitter produced a beam approximately 500 miles long and 300 miles wide which formed a giant "footprint" on the earth. In a single broadcast STD could cover an area from Canada to Mexico.

The STD project was planned to test the communications capabilities provided by the ATS-6. During the 1974-75 school year, the STD broadcast 450 hours of programming to rural schools. Half the time allotted to the STD each day was used to transmit to the eastern half of the Rocky Mountain region. On command from NASA control center at Goddard Space Flight Center in Greenbelt, Maryland, the spacecraft was repointed and the "footprint" transmission shifted to the western half of the region where the programming was repeated.

The signals transmitted by the ATS-6 were intercepted on the ground by antenna/receivers designed by Denver-based STD Engineers. These receivers, which cost about $4,600 installed, were the lowest-priced equipment of their type ever produced. Twenty-four installations, all at schools, were designated as IT's (Intensive Terminals) and had two-way audio capability. The other 45 installations were called ROT's (Receive-Only Terminals); the ROT's received the satellite signals but could not communicate back through the satellite system. Twelve of the ROT installations were at public television stations in the region, enabling live or delayed broadcasts of

The STD uplink was designed for operational simplicity and low cost. The equipment for the station, which was operational 99.64% of the time, was arranged to maximize convenience of operation and reliability.



STD programs. Public television broadcasts added thousands of viewers in the region's urban areas to the STD audience.

A color television signal, which could be accompanied by up to four voice channels of broadcast quality, was transmitted to each footprint. The ATS-6 was also able to send and receive telephone, telegraph, television, radio, facsimile, and computer data impulses to and from selected sites in the Health, Education, Telecommunications Experiments.

The ATS-3 (which was launched November 5, 1967, and is in geosynchronous orbit over the Atlantic Ocean) was used to relay audience responses from the 24 Intensive Sites to the studio teachers in Denver. Thus, a student in a classroom in Challis, Idaho, was able to communicate with specialists at the Denver Network Coordination Center (NCC) via the ATS-3, enabling instantaneous response and participation. Furthermore, the ATS-3 allowed participants at IT sites to communicate with each other. The research findings clearly support that the interactive capability was one

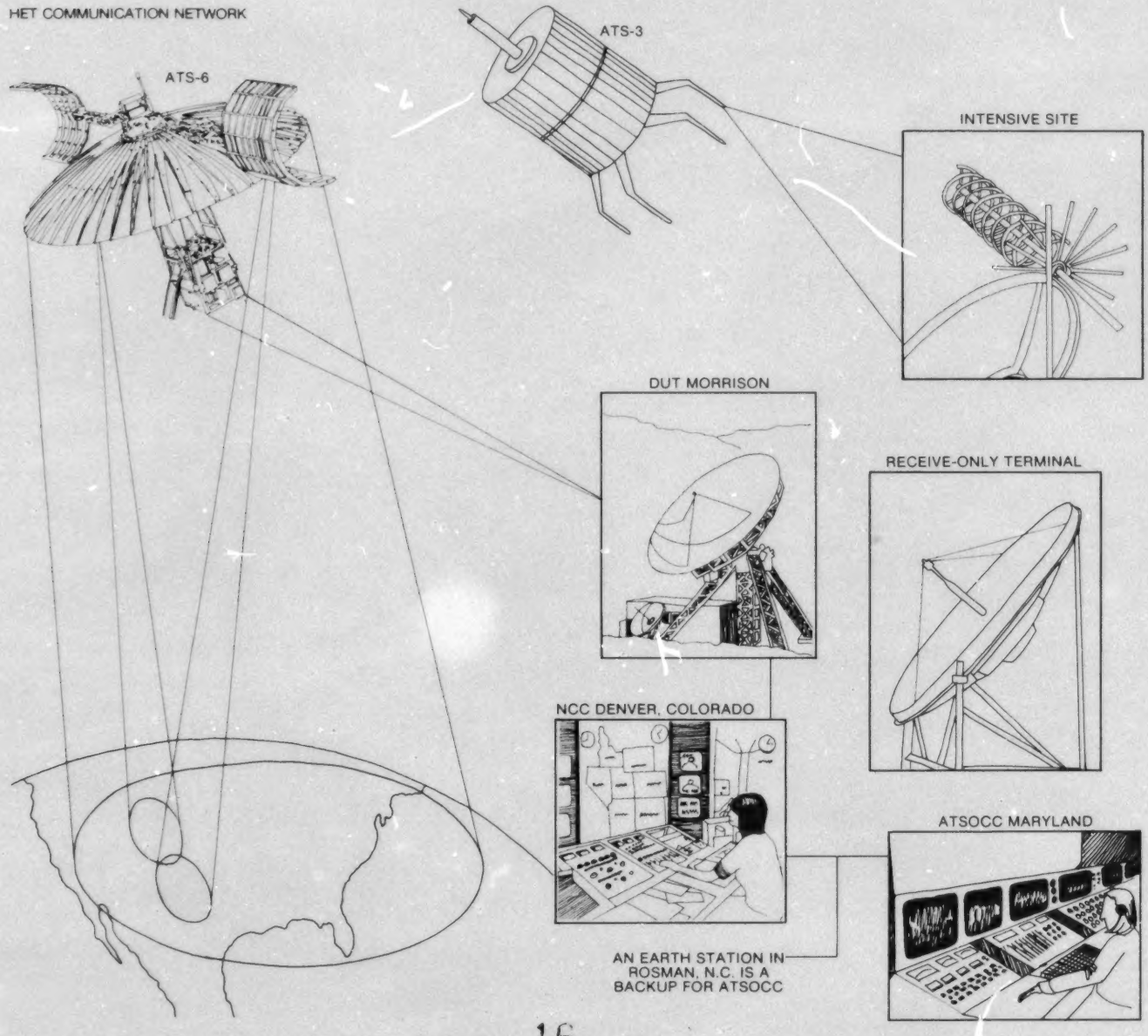
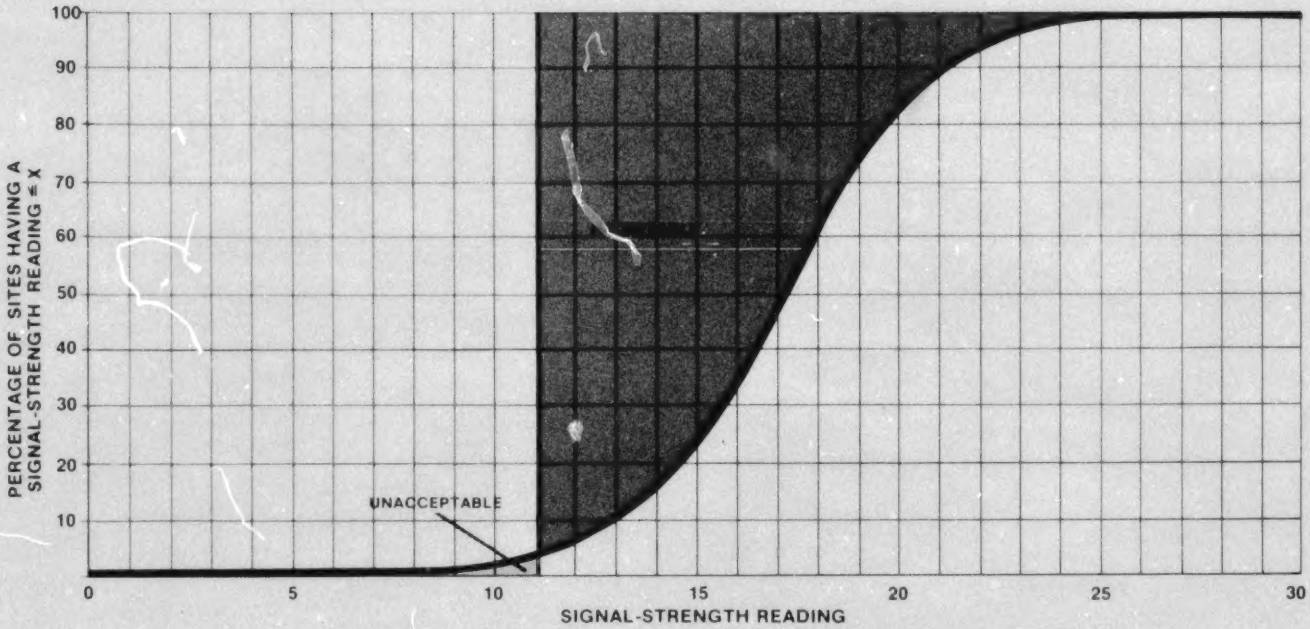


FIGURE 1 **CUMULATIVE PERCENTAGE HP SIGNAL-STRENGTH READINGS**



of the key features of the Demonstration.

The STD and NASA were vitally concerned with signal quality. The question was, "Can new spacecraft technology, coupled with the STD-engineered low-cost ground receivers, produce a television signal of sufficient quality and consistency to become a reliable educational, training, and social service tool?" The answer was, "Emphatically, yes."

The hardware performed efficiently throughout the life of the Project. Referencing Figure 1, the data shows that the signal quality exceeded design specifications 98 percent of the time. STD participants rated both video and audio intelligibility as equal to or exceeding the quality of commercial television signals. Temperature changes had no discernible effect on picture or sound quality. Normal cloud, rain, and snow conditions had no measurable effect on reception. Extreme ice build-up on the antenna surface, when left unattended, caused only minor picture distortion. The equipment failure rate was about one percent, resulting in a mean time for repair of slightly less than one program interval. No site was inoperable more than one day as a result of failure of system equipment.

During the first few months of operation, voice communications signals from ATS-3 suffered from extreme, unpredictable fluctuations in quality. Modifications made to the transmission equipment to reduce the effects of radio frequency interference in the Denver metropolitan area resulted in improved voice interaction performance during the second semester's programming. In addition, NASA also agreed to full power operations of the spacecraft. Digital transmissions successfully tested late in the programming year demonstrated that the employment of digital capabilities would have enhanced the effectiveness of the delivery system.

Local school staff personnel were trained to operate the transmitting and receiving equipment. Even though few had previous electronic or radio communications training, all learned to operate the equipment quickly and expertly. Consequently, operator error accounted for less than one percent of the broadcast system downtime.

The Denver-based facilities for the coordination of the HET network were designed and built by STD engineers. The satellite access terminal or uplink, although designed without total redundancy capabilities, worked well. Failure time including that caused by local power outage was 117 minutes, or less than one-half of one percent of operational time. In fact, the quality and reliability of the uplink facilities exceeded expectations.

CAREER EDUCATION PROGRAMMING

Because of national and state priorities which existed prior to the funding of the Project, career education was selected as the topic of STD programs. A subsequent study conducted by the STD revealed two factors that served to define the intended audience for the broadcasts. First, it was determined that career education had been a developing program in elementary schools for some time. Second, many high school students had access to vocational and other "hands-on" experiences, but an educational void existed in the middle grades. Accordingly, it was decided that the programming would focus on students in grades 7, 8, and 9.

During the course of the STD, career education programs were broadcast to students at both Open and Closed Sites. Closed Sites were those where STD equipment had been installed to receive programming directly from the ATS-6. Open Sites were schools which received the programs from public television stations or via cable and translator systems.

The career education programming entitled, "Time Out" was broadcast Monday through Friday during both the first and second semesters of the 1974-75 school year. Pre-taped segments of the Monday through Thursday programs lasted 28 minutes 50 seconds to allow public television stations to carry the series in a standard half-hour time period. These pre-taped segments included dramatized situations and existing filmic materials selected according to appropriateness. The series emphasized self-assessment, career exploration, and decision-making, stressing the options available to each student in relation to individual needs and abilities. An additional six minutes of daily programming featured live audio interaction between students and the Denver staff. In contrast to the pre-recorded programs, 12 Friday programs per semester were broadcast live and were produced with a variety of formats. Although extensive modifications were precluded by time and budgetary constraints, second semester programs included revisions based on audience and STD staff review of the first semester broadcasts.

The production of "Time Out" was accomplished through a production system new to educational television called the "courseware team" approach. Existing materials were previewed for integration into the series. A content process was developed to guarantee the educational integrity of the programs.

TABLE 1
JUNIOR HIGH SCHOOL AUDIENCES
1974-75 SCHOOL YEAR

	TOTAL JUNIOR HIGH (7,8,9) ENROLLMENT	JR. HIGH ENROLLMENT RECEIVING PTV		TOTAL JUNIOR HIGH DISTRICT ENROLLMENT FOR STD OPEN SITES	CONFIRMED OPEN AUDIENCE[1] PARTICIPATION	CONFIRMED CLOSED SITE[2] PARTICIPATION
		%	NUMBER			
ARIZONA	131,000	70	91,700	14,936	885	402
COLORADO	142,380	89	126,718	33,794	1,656	760
IDAHO	50,963	76	39,088	30,279	2,548	561
MONTANA	45,211	34	15,494	11,460	1,030	720
NEVADA	34,136	87	29,698	28,608	1,840	996
NEW MEXICO	78,986	71	56,080	36,629	3,343	431
UTAH	74,587	98	73,095	56,540	3,404	703
WYOMING	21,955	70	15,369	13,290	2,213	1,020
TOTALS	579,218		447,242	225,536	16,919	5,593

[1]Not every junior high school in the districts had access to PTV and not all open site junior high school students viewed STD programming.

[2]Confirmation based on print material orders and direct contact. There is evidence that others participated in STD programming but not on a regular basis and without use of print materials.

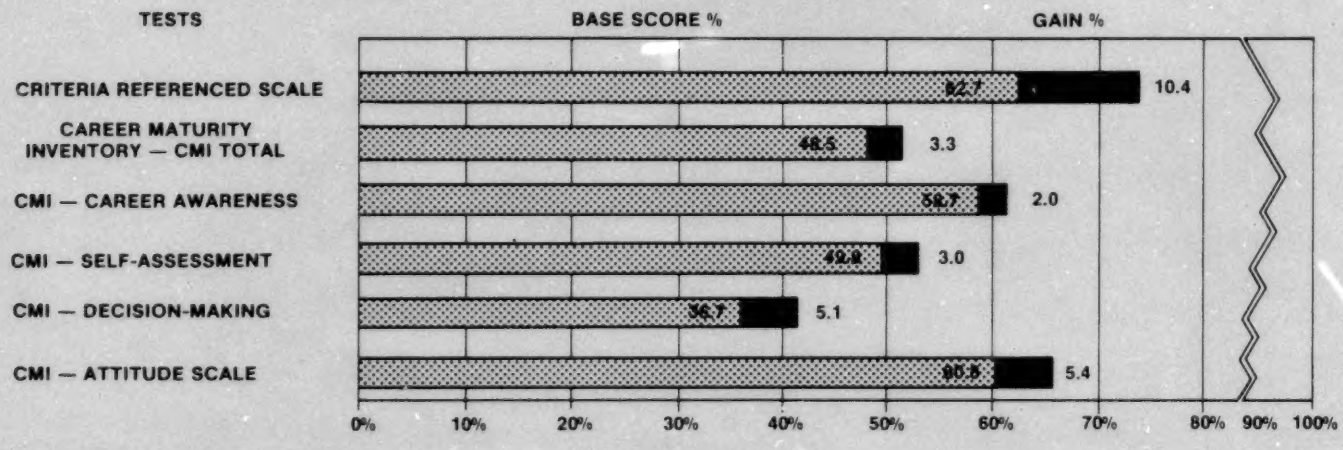
Various television formats and vehicles were analyzed to identify those appropriate to the junior high school audience. An in-house studio facility was built for the production of the pre-taped and live segments of the programming.

The developmental process included four major steps with several activities within each step. These steps included: (1) identification and development of content; (2) development and refinement of scripts; (3) production and refinement of programs; and (4) refinement of television programming during the operational period. This sequence of activities was designed to assure optimum program quality within the available resources. The data base shows that students posted significant knowledge gains after viewing the programs. The largest gains were made by the students at the IT sites who participated in the audio interaction.

By presenting meaningful, informational broadcasts, the STD helped adolescents develop decision-making skills and encouraged better utilization of educational and training resources in the region's rural schools.

Print materials designed to supplement "Time Out" included a teacher guide and a student magazine. The teacher guide contained a variety of discussion

FIGURE 2
PERCENTAGE OF CAREER RELATED KNOWLEDGE GAINS



questions and activities enabling them to select appropriate materials for their students. The guide included an introductory issue and four subsequent updates. The student magazine was issued four times per semester to each student in the 56 participating sites and contained articles, games, puzzles, and artwork designed to encourage student acceptance and learning. All print materials were available for purchase by Open Sites. The materials were revised for second semester use.

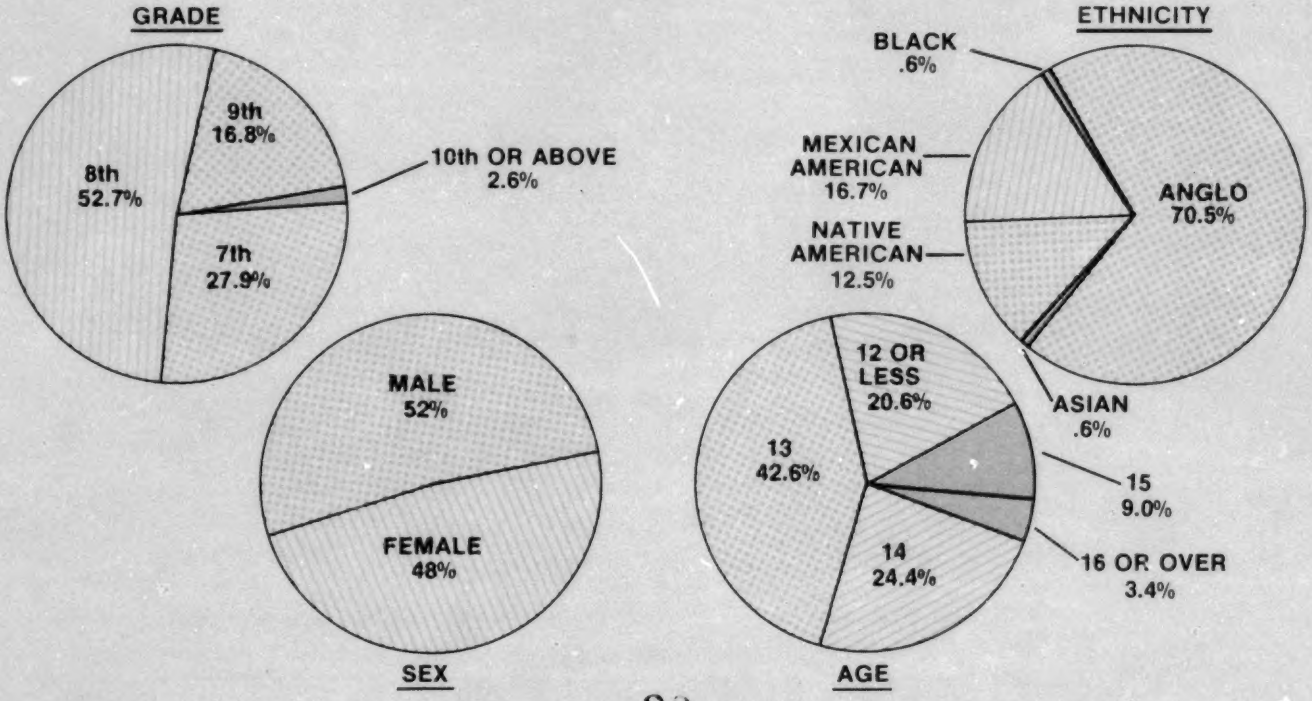
Print support materials were also available for the other STD programs: "Footprints," "Careers and the Classroom," and the Materials Distribution Service (MDS). An MDS catalog listed the titles alphabetically and provided program information for teachers to use in ordering films for satellite distribution. Teacher guides included suggestions regarding classroom applications of the films. In-service participants received updates which included an outline of the presentation and background information on the program speaker.

Site coordinators received materials for publicity and follow-up activities connected with "Footprints." Flyers, posters, and other promotional materials were used to attract audiences. If community interest suggested additional activities, listings of available local, state, and national resources and suggestions for subsequent activities were available.

STD STUDENT POPULATION

Analysis of population data indicated that 5,593 students at the 56 STD Closed Sites viewed "Time Out" and an additional 16,919 students viewed the programs as they were re-broadcast by participating public television stations in the region. These 22,512 students comprised the total confirmed "Time Out" audience. Demographic data on the STD research classes, numbering 3,446 students at the 56 sites, have been presented in Figure 3.

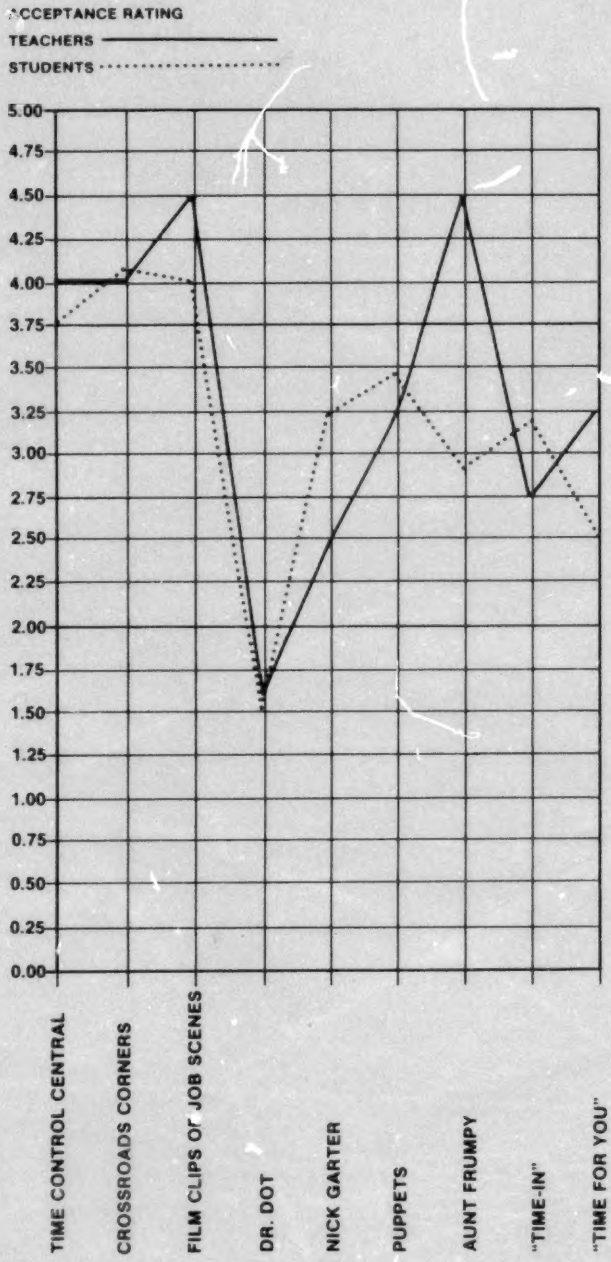
FIGURE 3



AUDIENCE ACCEPTANCE OF TIME OUT

FIGURE 4

ACCEPTANCE RATINGS OF "TIME OUT" ELEMENTS BY STUDENTS AND THEIR TEACHERS



The "Time Out" series utilized a number of different formats to explain career concepts. Time Control Central was a major format and used a science fiction set and a futuristic approach. It provided a vehicle to move forward or backward in time, to access a computer for information, to recall film clips, and to smoothly bridge other program formats.

Program formats included Crossroads Corner, which featured teenagers in a rural setting; film clips of job scenes; Dr. DOT, a carnival-type character used to explain the **Dictionary of Occupational Titles**; Nick Garter, a comic detective; puppets used to explain attitudes; Aunt Frumpy, who answered letters; "Time In," which was six minutes of daily audio interaction; and "Time for You," 12 Friday 30-minute interactive programs. Acceptance levels for all program segments have been specified in Figure 4.

Members of the Time Control Central crew work out a decision while junior high students gather at Crossroads Corners store to talk about career education. Both formats were used in STD's "Time Out" series.

Fred Rogers (right) participates in live interaction with a viewer at one of STD's 24 Intensive Terminals. Dave Minshall, host for the "Footprints" series, joins discussion in STD studio in Denver

FOOTPRINTS

"Footprints" was selected as the title for the adult evening series. The purpose of each program was to provide assistance to communities in recognizing some of the area's problems and concerns. The final schedule of program titles and topics included: "Order No: 461111-LT7" (mail order consumerism); "The Space Between Us" (interpersonal communication); "The Great Land Race" (land use); "For Purple Mountain Majesty" (cultural heritages); "The Job Jungle" (career development for all); "Super-Cooperatives" (farm cooperatives); "Misterogers! Every Child's Neighbor" (early childhood education); "Is There a Doctor in the County?" (rural medicine); "Don't Hold Us Back" (senior citizens); and "Brass Tacks" (a summary of the STD with a look to the future).

Aside from two programs ("Purple Mountain Majesty" which was completely pre-recorded and "Brass Tacks" which was a live panel discussion), the format for "Footprints" consisted of an opening title sequence, pre-recorded topic exposition, interaction, and closing sequence. Panel members and moderators were selected for their subject-matter knowledge and their ability to communicate. Sites were asked to contribute suggestions concerning the selection of these participants. Although attendance for evening programs was small, interaction was lively and was perceived by viewers as being most useful and pleasurable. The evaluation reveals that the "Footprints" series was generally well accepted by evening audience members.

MATERIALS DISTRIBUTION SERVICE

The STD's Materials Distribution Service (MDS) was designed to increase the scope and flexibility of rural school curricula. Through this service, the STD Closed Sites were able to gain access to a variety of high quality films and videotapes which were broadcast via the ATS-6. These filmic materials were recorded and used by the schools at their convenience throughout the 1974-75 school year. Because of copyright restrictions, public television stations could not receive and broadcast this service; consequently, Open Sites were unable to participate.

The content of the MDS film library was determined primarily by teachers at the participating sites. These teachers selected films from catalogs provided by the Encyclopaedia Britannica Educational Corporation and the Great Plains National Instructional Television Library. Their selections were tabulated, and on the basis of these results, the STD obtained a total of 426 films — 300 from Encyclopaedia Britannica, 100 from Great Plains, and 26 from various other sources. (Of these, approximately 35 films were intended for use in conjunction with the "Footprints" programs.) The final list of films covered topics from all subject areas (K-12) and contained materials suited to the interest of students. Using a catalog and teacher guides developed by the STD, site personnel requested films for broadcast. On this basis, a broadcast schedule was developed for each three six-week periods per semester.

Although the MDS was not officially incorporated as a part of the STD project until November, 1973, the participating STD sites enthusiastically supported the program. Despite the fact that school budgets had already been determined for the 1974-75 school year, 54 of the 56 participating schools found the means to purchase the videotape cassette recorders and the quantities of tape necessary to make effective use of the service.

MDS was extensively utilized. During the 1974-75 school year, 7,068 recordings were made, and a total of 190,078 viewings have been documented. In all, a total of 162 hours of satellite time was used for Materials Distribution.

The only problem encountered in the broadcasting of MDS was a lack of sufficient satellite time to meet all the film requests from participating sites. In the future, this problem could be alleviated by the use of video compression which would enable the distribution of more video material in a shorter period of time.

The impact of the Materials Distribution Service will be felt far beyond the life of the STD. The equipment and quantities of tape purchased by the sites will be of use in their educational programs. Furthermore, upon conclusion of the MDS program, the STD was able to negotiate an arrangement with the Encyclopaedia Britannica Educational Corporation whereby participating sites were allowed to purchase the titles they had videotaped at a relatively low cost. Those videotaped films are now a permanent part of the schools' resources.

TABLE 2

MATERIALS DISTRIBUTION SERVICE ATTENDANCE

NUMBER OF FILM RECORDINGS	NUMBER OF SHOWS TO AUDIENCES	TOTAL AUDIENCE ATTENDANCE	AVERAGE MATERIAL RATING[1]
7,068	4,709	190,078	1.51

ATTENDANCE BY AUDIENCE TYPE

K-6	7-9	10-12	ADULT/OTHER
58,949	75,076	53,488	2,565

[1]Material Rating: (Based on perceived audience acceptance and benefit) 1 = Excellent; 2 = Good; 3 = Fair; 4 = Poor

CAREERS AND THE CLASSROOM: A NEW PERSPECTIVE FOR TEACHERS

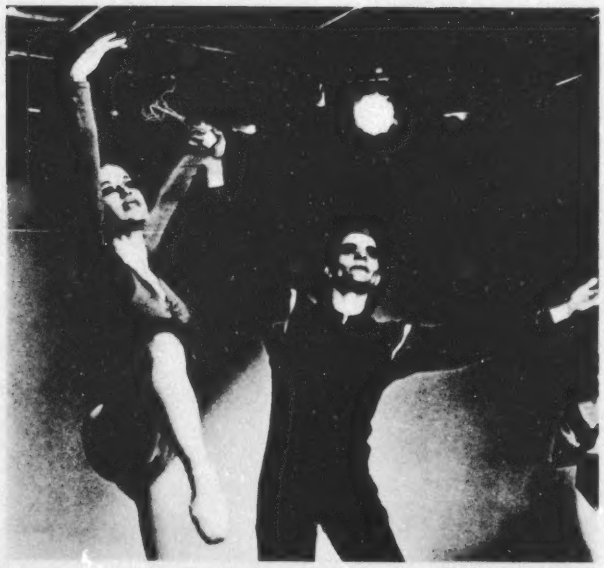
To broaden the impact of the STD project, a teacher-oriented series of career education programs was developed to supplement the student-oriented "Time Out" series. This series, entitled "Careers and the Classroom: A New Perspective for Teachers," was designed to inform all interested educators in participating districts about career education and to encourage them to utilize the principles of career education in their classroom activities. Broadcast biweekly from September 5, 1974, to May 1, 1975, the programs in this series dealt with 16 career-related topics. Program titles included in the series were: "Career Education Is for Everyone," "Continuing Education's Role," "The Dictionary of Occupational Titles," "Honest Self-Assessment," "Values and Strategies in Decision-Making," "Organizing and Facilitating Independent Learning," "Career Guidance Resources," "Career Education and the Standard Academic Curriculum," "Overcoming Biases in Counseling Students," "Ecology/Environment — How Do They Impact Upon Careers," "Unions and Career Education," "Job Security," "Tomorrow's Careers," "Earning a Living Is Not Enough — The Art of Intelligent Spending," "Effects of Change on the World of Work," and "Career Education Today."

Each program in the "Careers" series had a similar format. Two STD staff moderators introduced the presenter responsible for a given program. The presenter lectured for 10-30 minutes, followed by an interaction session via satellite. Each program was 55 minutes in length.

All site participants in the "Careers" series received information about each program. The program reviews contained biographies of the presenters and outlines of the presentations. In addition, during the course of each program, presenters would frequently recommend supplementary materials to be used for further work on an individual basis.

Several regional colleges and universities offered graduate credit to participants in the "Careers" series, and 554 educators took advantage of this opportunity. In addition, 322 teachers who participated in the program received recertification credit from their state department of education. The "Careers" series met the needs of teachers for this type of programming. The teachers, however, expressed a preference for multimedia presentations rather than a talk-show format.

SPECIAL PROGRAMS



In the Denver studio, the Colorado Concert Ballet performs via ATS-6 for ballet master at Lincoln Center for the Performing Arts. Special program, with live interaction, was produced by STD for the American Association for the Advancement of Science annual meeting in New York City.

In addition to the regularly scheduled program series described earlier ("Time Out," "Careers," and "Footprints"), the STD staff also developed and produced a number of programs for specialized audiences. Eighteen special satellite "feeds" were made between July 9, 1974, and May 16, 1975. Each of these further demonstrated the flexibility of a satellite-based broadcasting system.

On July 31, 1974, a special presentation was broadcast from Denver to Washington, D.C., giving general information about the STD and showing a portion of the "Villa Alegre" series developed by Bilingual Children's Television. In attendance at this presentation were individuals representing the Congress, National Institute of Education, the Office of Education, NASA, the United States Information Agency, Fairchild Industries, and several unaffiliated but interested individuals. This broadcast was one of several made to individuals representing the private sector, the legislative and executive branches of the federal government, and various regulatory agencies.

Special presentations were made to the Space Applications Board of the Academy of Engineers, the Institute of Electronic and Electrical Engineers, the Russian Minister of Health, the Space and Missile Systems Organization, the Society of Motion Picture and Television Engineers, the National Association of Educational Broadcasters, and the American Association for the Advancement of Science.

Several special news programs were transmitted through the Project's network to the residents of Juneau, Alaska. These programs included the resignation of President Richard Nixon and the acceptance speech of President Ford. Programs were fed from Washington, D.C., to Denver via the Public Broadcasting Service land lines. The broadcast link from Denver to Juneau was provided by the ATS-6.

The leading project scientist for NASA's Viking Project utilized the STD network to make two presentations describing the Viking Mars mission. Science students at Intensive Sites were given the opportunity to question the guest scientist while other participants viewed and listened to his immediate responses.

A program prepared on behalf of the American Association for the Advancement of Science involved the live broadcast of a ballet performance. This program originated from the STD studio and was broadcast to the Lincoln Center for the Performing Arts in New York City to an audience of UNESCO representatives and others interested in the application of science and technology to the arts. To demonstrate the interactive capability, the performance was critiqued live from New York City.

A special program feed to the Rocky Mountain Regional Medical Conference in Bozeman, Montana, demonstrated the potential use of satellite broadcast systems in the medical field. Such systems would be able not only to serve as a teaching tool for medical personnel far from urban areas, but also to provide medical assistance in life-and-death situations.

The Emergency Medical Technicians Refresher Course was a joint effort of the Federation, the Mountain States Health Corporation, the Rocky Mountain Corporation for Public Broadcasting, and the Robert Wood Johnson Foundation. It consisted of a series of seven programs designed to serve as a refresher course for certificated emergency medical technicians. This series made available to technicians in remote areas the expertise of leading medical authorities in the region.

INTERACTION

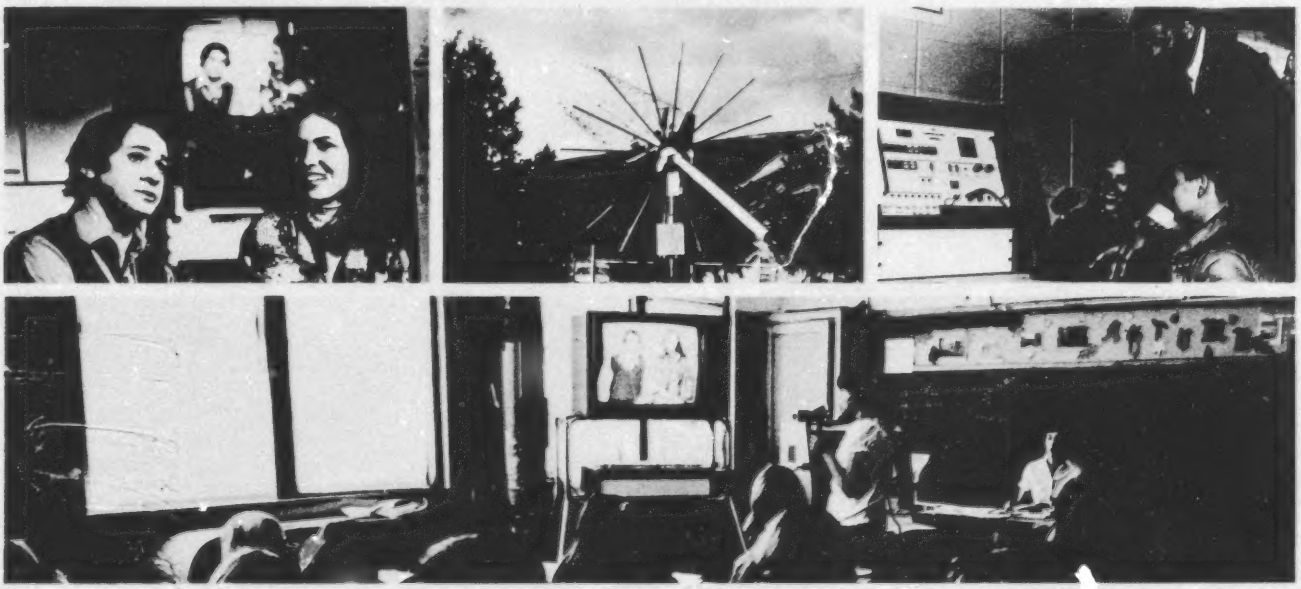
Live interaction via the ATS-3 was a major aspect of the STD project. This capability, which allowed STD participants to communicate with one another and with STD staff in Denver, was intended to achieve three objectives: to increase the educational value of STD programming, to increase the acceptance of such programming, and to investigate the effectiveness of various live program formats.

Interaction Using the ATS-3

The interaction system employed by the STD involved the use of NASA's ATS-3. This system was an integral part of the junior high school education series. Sixty-nine of the eighty-one half-hour programs in this series were pre-recorded presentations followed by six minutes of live programming, during which students asked questions and provided comments concerning the broadcast. During the first semester, these six-minute segments, entitled "Time In," were moderated by two staff members at the STD studio in Denver. Additional STD personnel off-camera provided a "knowledge pool" for answers to content-specific questions, most of which involved requests for information about training requirements and aptitudes, interests, and temperaments associated with various careers.

There were also 12 half-hour live presentations each semester entitled "Time Out: Time For You." These programs were designed to stimulate interaction between STD students and content experts in the Denver studio. During the first semester, STD experimented with a variety of formats in this area including: mini-dramas, in which teenagers presented "conflict" situations intended to elicit comments from participating STD students; debates, in which two Intensive Sites supported opposing positions on a given career topic while students at the remaining sites provided questions and comments; and "knowledge pool" programs, which were essentially an extension of the "Time In" broadcasts encouraging students to seek information relating to various career alternatives.

During the second semester of "Time Out: Time For You" broadcasts, the panel show format was retained, and two additional types of live programming were provided. The first new program series featured experts from several educational areas beyond the secondary level. Representatives from colleges, universities, junior and community colleges, private and public vocational-technical schools, and union apprenticeship programs responded to student questions in their respective areas of specialization. The second type of new programming was produced at the local level by students. Interested sites were encouraged to prepare program segments dealing with



careers in their own communities. Films, slides, scripts, and audio tapes were collected, organized, and sent to Denver where the STD production staff prepared the materials for broadcast. Following each individual site presentation, the remaining Intensive Sites were given the opportunity to comment on and ask questions about the program.

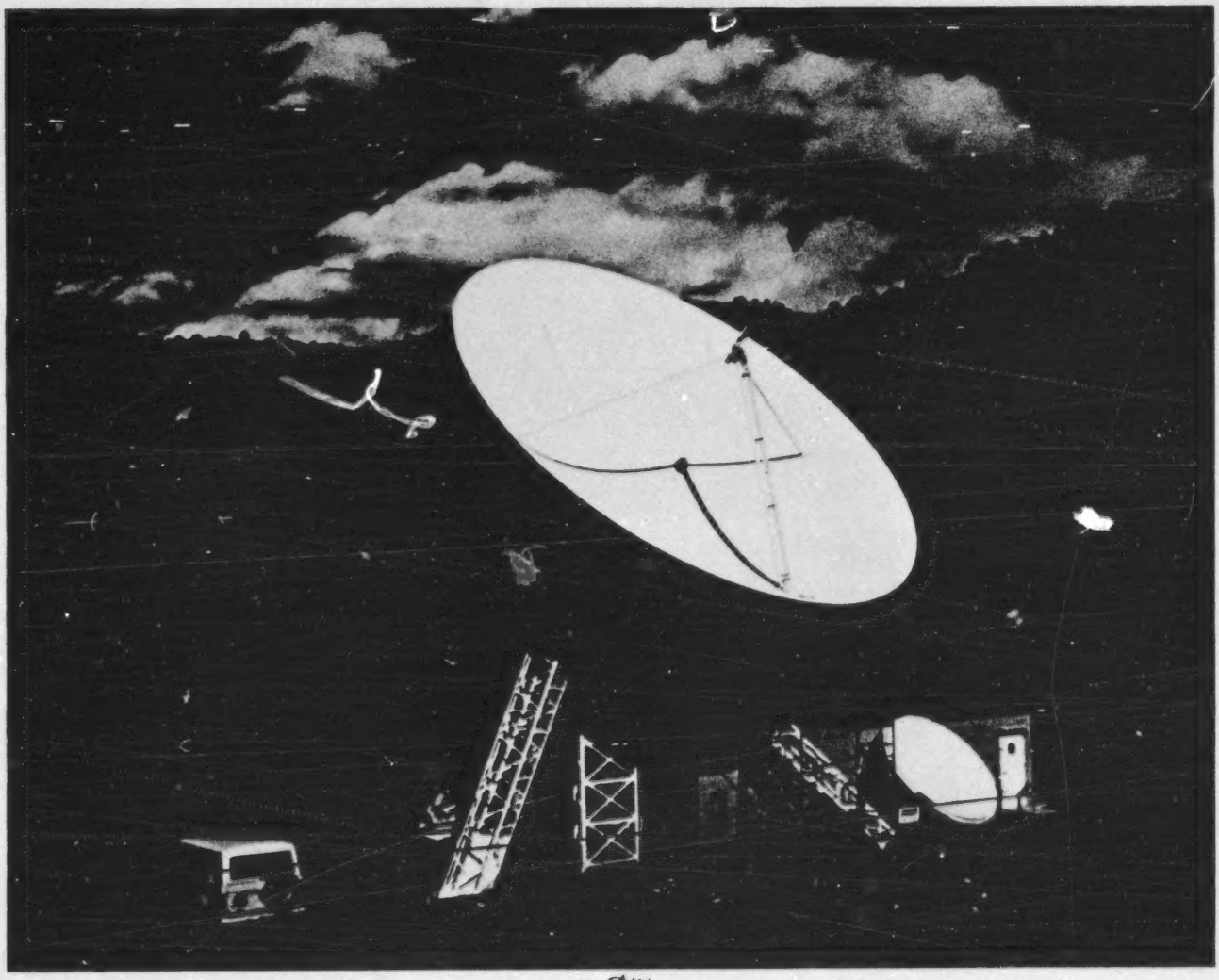
Interaction Without the Satellite

In the live segments of STD programming which emphasized interaction and involved Intensive Sites directly, every attempt was made to include students at the ROT Sites. Program topics were announced as far in advance as possible and questions by mail were solicited. Letters received from students at ROT Sites were acknowledged and answered during the live broadcasts.

Digital Interaction

The original STD proposal included plans for live interaction through the use of digital pads at participating STD sites. Unfortunately, a lack of funding precluded full implementation of these plans. The STD was able to conduct a series of limited tests during the spring of 1975, which demonstrated the feasibility of such a system.

To interface with the global-beam of the ATS-6, the uplink earth station at Morrison, Colorado operated at 4 and 6 GHz. The station used a 3 kW transmitter, an uncooled low-noise parametric amplifier, and an 11-meter (36 foot) prime focus parabolic antenna.



SUMMARY OF STD SERVICES

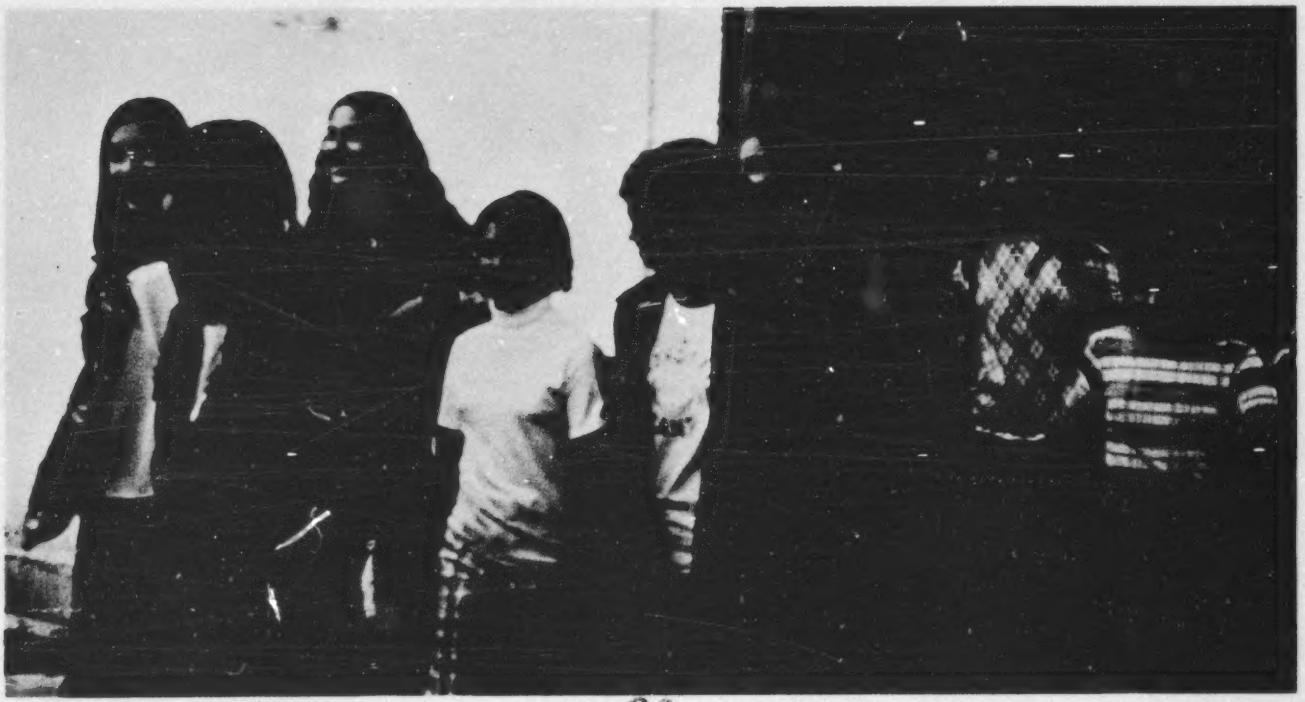
The Satellite Technology Demonstration designed, developed, implemented, and tested an elaborate technical communications network, programming for a wide variety of users, and a comprehensive field support system.

Despite extreme weather conditions, the technical network operated efficiently with a minimum of interruption of services. Signal quality far exceeded minimum design specifications. The STD designed ground receivers proved to be a suitable low-cost network component, complementing the high-powered transponders of the ATS-6.

The STD programs attracted a larger share of the viewing audience than public television broadcasts in general. "Footprints" attracted 3.31 percent of contacted viewers and "Time Out" was viewed by 4.13 percent of the non-school respondents in comparison to a February, 1975, Nielson survey which found 2.8 percent of the general audience viewing public television. Acceptance of the programming was generally high and student knowledge gains were gratifying. The largest gains were made by Mexican American students, which is of particular interest since the programs were generic in design and not intended for any specific audience.

The field support system involved over 200 state and local educational professionals and technical specialists in carrying out the planning, development, and operational tasks of the STD. A significant legacy of the STD is the "user" system comprised of professional policy makers, managers, teachers, citizen boards, advisory panels, parents, and young people in 8 states, 56 communities, and 12 public television coverage areas.

The STD delivered educational materials and services to a wide range of audiences in an area nearly one-fourth the size of the United States at a cost of slightly over $11,000,000. While a satellite system has been demonstrated to be a technologically feasible means of distributing educational services, any judgment about the efficiency of the system must be made after carefully comparing costs to the advantages of satellite distribution under specified conditions.



PROJECT COSTS

Project Funding and Expenses

The Satellite Technology Demonstration was a cooperative endeavor involving the coordination of efforts among local schools, state departments of education, state governmental agencies, federal agencies, public broadcast stations and their regional network, and the Federation of Rocky Mountain States, Inc.

Three federal agencies provided the STD funding totaling $11,329,423. The contributions came from the National Institute of Education, $4,252,412; Office of Telecommunications (DHEW), $2,279,530; and the United States Office of Education, $4,797,481. The STD was completed in three major phases: planning, development, and operation. The approximate costs were planning, $4,000,000; development, $4,600,000; and operation, $2,700,000.

The STD component structure was based on functional activities related to the products and services. The costs for each have been shown in Table 3.

TABLE 3
COSTS BY COMPONENT

BROADCAST AND ENGINEERING **COMMUNICATIONS NETWORK DESIGN AND IMPLEMENTATION INCLUDING THE DENVER UPLINK AND NETWORK COORDINATION CENTER FACILITIES.**	**$2,900,000**
PROGRAM **CONTENT DESIGN AND VIDEO PRODUCTION.**	**2,800,000[1]**
UTILIZATION **FIELD ORGANIZATION AND SUPPORT SERVICES.**	**1,400,000**
RESEARCH **DESIGN, DATA PROCESSING, AND ANALYSIS.**	**500,000**
ADMINISTRATION **MANAGEMENT, PUBLIC INFORMATION, AND SUPPORT COSTS, I.E., RENT, UTILITIES, AND SUPPLIES.**	**2,000,000**

[1]Does not include the $1,700,000 cost of early childhood programming which was phased out of the Project in July, 1973.

STD PROGRAM AND SITE SUPPORT

A major STD activity involved the development and delivery of career education programs to junior high school students. An analysis of the expenses incurred during the development of these programs revealed their cost to be approximately $24,500 per hour. This represents a significant achievement when compared with the production costs of other dramatic educational series produced for public television stations, which range from $30,000 to $60,000 per hour. A similar analysis indicates that the production cost per hour for the teacher in-service series "Careers and the Classroom" was approximtely $6,000 per hour, and the approximate cost per hour for the "Footprints" series was $750.

The estimated cost of an STD site during the 1974-75 operational year (including equipment and human support services) was approximately $9,000 for a Receive-Only Site and $13,600 for an Intensive Site.

IN-KIND SUPPORT

One of the goals of the STD was to document the cost of delivery modes using varied STD materials. These costs were studied and extensive information is now avilable to provide guidance for the planning of future educational satellite technology applications.

An implicit long-range goal of the STD was to obtain state and local in-kind support to demonstrate Project commitment and the importance of local commitment in the adoption of appropriate programs and services. The level of in-kind support was encouraging to the STD and to outside observers, particularly those contributions made by school districts with limited funds.

In-kind support included expenses incurred by states and sites in addition to the STD's site support grant. Examples of such expenses are professional and classified salaries, office space, phone services, and office supplies. An average of $54,972 was contributed by each state during the life of the Project. Local in-kind support has been itemized in Table 4.

TABLE 4
SITE IN-KIND SUPPORT

	AVG. PER SITE	TOTALS
STAFF SUPPORT[1]		
PROFESSIONAL	$ 3,054	$ 171,015
CLASSIFIED	775	43,412
COMMUNICATIONS (PHONE, POSTAGE)	49	2,743
SUPPLIES (VIDEOTAPE, OFFICE SUPPLIES)	1,738	97,330
EQUIPMENT (TV MONITOR, VTR, ETC.)	2,817	157,737
EQUIPMENT MAINTENANCE	48	2,715
AVERAGE SITE EXPENSE	8,481	

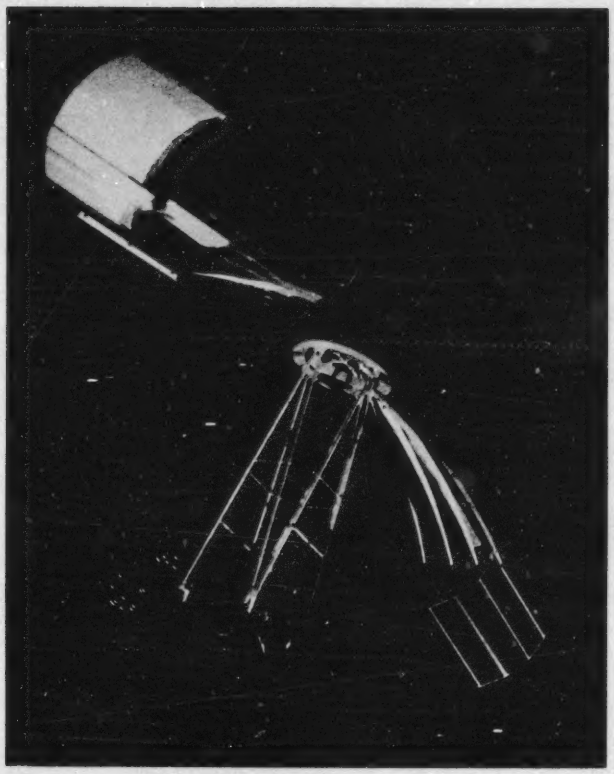
[1]Excluding site coodinator salary provided by STD site support grant.

In future projects, savings would be realized as the result of economies in large-scale purchase of equipment and facilities. Additional reductions in per user/hour costs would be effected by increasing the number of program offerings to users. The STD's per site cost for the operational year was determined by adding the average site expense of $8,481 (as reflected by in-kind support) to the Project costs for installation and operations. (See Tables 4 and 5.) In subsequent operational years, expentitures at STD sites would be reduced because of elimination of the initial start-up cost.

TABLE 5
SITE COSTS INCLUDING IN-KIND SUPPORT

	IT	ROT
PRO-RATED STD SITE COSTS	$ 13,618	$ 8,978
IN-KIND SUPPORT	8,481	8,481
TOTAL AVERAGE COST PER SITE	$ 22,099	$ 17,479

IMPLICATIONS AND CONCLUSIONS



The STD provided valuable experiences in the application of satellite technology to serve human needs. These experiences lend vital support and guidance for future developments utilizing the nucleus of experienced people available to facilitate such endeavors. The corps of persons with satellite experience is a valuable resource for the nation and the region, representing a capability for implementing future satellite projects.

The STD also provided significant information and results from which implications can be assessed and conclusions reached. For example, the Broadcast and Engineering staff found that the low-cost receiving and transmitting equipment provided exceptional picture and voice quality, thus offering encouragement for the development and design of similar hardware in the future. The equipment was reliable and easy to repair, and while occasional malfunctions did occur, performance records indicated little downtime. Cost and maintenance factors put the equipment within reach of small school districts in rural communities.

Another positive feature of the equipment was that it could be properly operated by non-technical, non-professional personnel who required a minimum of instruction and supervision. This offers encouragement for emerging nations which will use satellite communications for small, isolated communities unable to afford the costs of highly skilled technicians. The equipment was also adaptable to a variety of locations, installations, weather factors, and user demands.

A remarkable achievement of the STD was the coordination and blending of diverse interests and contributions of many people and organizations at the local, state, national, and international levels. Individual efforts reflected the tremendous enthusiasm and interest of participants. One reason for the positive involvement was that the Project design elicited local response so that programming could be modified to meet the needs of participating students.

A field support effort was implemented to help tailor the general STD programs to respond to unique local cultural, linguistic, and other demographic factors. These human support mechanisms contributed to program acceptance by students, teachers, parents, and the community.

In a survey conducted by the Federation of Rocky Mountain States, Inc., teachers, administrators, and school board members requested continued and expanded programming via satellite. Respondents indicated that more comprehensive services (student programming, in-service programming, distribution of existing materials, specific skills training for adults, etc.) are needed to justify the expenditure of additional funds. Essentially, the respondents seek further involvement, expanded technical capability, and more diverse services.

The success of the Emergency Medical Technicians Recertification program demonstrated that satellites can provide quality training in many professional and technical areas. In-service training has been requested and could be provided for police, firemen, wastewater operating engineers, and city planners. Satellite communications would appear to offer much potential for in-service training by making expertise available to large numbers of professionals.

A significant adjunct of the STD and the HET Experiments was the incorporation of the Public Service Satellite Consortium (PSSC). The PSSC was organized by selected ATS-6 users and by other organizations who recognized that the accomplishments of HET were compatible with and supportive of their communication, educational, and social needs. Numerous organizations, including states, regional commissions and compacts, national agencies, and national professional organizations have joined or plan to join the PSSC. A major goal of the Consortium is a satellite dedicated to social service with technical attributes based on the needs of the user organizations.

There are audiences, agencies, and organizations who believe that satellites are communications devices "whose time has come." On the basis of the ATS-6 experiences, the users are now ready for the benefits of a full-scale satellite delivery system. There is local and regional enthusiasm for using the new technology. The test bed, which includes local receiving equipment, the Network Coordination Center, the uplink, trained staff, and committed users, remains in place in the region awaiting the return of the ATS-6 from India.

With ATS-6 and the Satellite Technology Demonstration, the social implications of satellite communications are no longer a matter of conjecture, discussion, or debate; they are a reality which we must exploit. Telecommunications via satellite is certain to increase substantially in the next decade. Fitting satellite technology to the needs of all Americans—urban and rural—will be difficult, but the rewards and promises are substantial.

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More detailed information on the Project is available from the Federation of Rocky Mountain States, Inc.

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